

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.

Appl. No. 09/724,548
Amdt. dated Sep. 13, 2004
Reply to Office action of Apr. 13, 2004

Amendments to the Claims:

This listing of the claims will replace all prior versions, and listings, of claim in the application:

Listing of the Claims:

- Claim 1. (original) A microfluidic device comprising:
- a loop channel communicating with at least one service channel,
- a microvalve separating the loop channel from the service channel, a pump associated with the loop channel.
- Claim 2. (original) A device of claim 1, wherein the at least one service channel comprises at least one inlet and one outlet.
- Claim 3. (original) A device of claim 1, wherein the pump is a peristaltic pump.
- Claim 4. (original) A device of claim 2, wherein each inlet and outlet is separated from the loop channel by a microvalve, and wherein the pump comprises at least three cooperating micro valves acting within the loop channel.
- Claim 5. (original) A device of claim 1, further comprising a set of target molecules disposed within the loop channel.

Appl. No. 09/724,548
Amdt. dated Sep. 13, 2004
Reply to Office action of Apr. 13, 2004

Claim 6. (original) A device of claim 1, wherein the pump comprises at least three cooperating microvalves acting within the loop channel, and further comprising a set of target molecules disposed within the loop channel.

Claim 7. (original) A device of claim 5, wherein the target molecules are polynucleotide probes.

Claim 8. (original) A device of claim 5, wherein the target molecules are protein probes.

Claim 9. (original) A device of claim 5, wherein the target molecules are antibodies.

Claim 10. (original) A device of claim 5, further comprising at least one detection region coincident with at least a portion of the loop channel.

Claim 11. (original) A device of claim 6, further comprising at least one detection region coincident with at least a portion of the loop channel and at least one detector associated with at least one detection region.

Claim 12. (original) A device of claim 1, wherein the loop channel resides in a layer of

Appl. No. 09/724,548
Amdt. dated Sep. 13, 2004
Reply to Office action of Apr. 13, 2004

elastomeric material.

Claim 13. (original) A device of claim 4, wherein the loop channel resides in a layer of elastomeric material, and the valves are formed from an elastomeric membrane.

Claim 14. (original) A device of claim 6, wherein the loop channel resides in a layer of transparent elastomeric material and the valves are formed from an elastomeric membrane.

Claim 15. (original) A device of claim 14, further comprising at least one detection region coincident with at least a portion of the loop channel.

Claim 16. (original) A device of claim 12, wherein the elastomeric layer is adjacent to a substrate layer.

Claim 17. (original) A device of claim 13, further comprising at least one detection region coincident with at least a portion of the loop channel, and wherein the elastomeric layer is adjacent to a transparent substrate layer.

Claim 18. (original) A device of claim 14, wherein the elastomeric layer is adjacent to a transparent substrate layer.

Appl. No. 09/724,548
Amdt. dated Sep. 13, 2004
Reply to Office action of Apr. 13, 2004

Claim 19. (original) A device of claim 1, wherein the loop and service channels reside in a treatment layer, and further comprising a control layer adjacent to the treatment layer and carrying control lines.

Claim 20. (original) A device of claim 19, wherein the treatment and control layers are elastomeric.

Claim 21. (original) A device of claim 20, wherein the treatment and control layers are bonded to each other.

Claim 22. (original) A device of claim 21, wherein at least one of the treatment and control layers is transparent.

Claim 23. (original) A device of claim 19, wherein the control lines comprise at least one channel which is carried by the control layer and which intersects at least one channel carried by the treatment layer.

Claim 24. (original) A device of claim 23, wherein at least one intersection of channels forms a microvalve.

Appl. No. 09/724,548
Amdt. dated Sep. 13, 2004
Reply to Office action of Apr. 13, 2004

Claim 25. (original) A device of claim 24, wherein the microvalve comprises a deformable membrane between a treatment channel and a control channel.

Claim 26. (original) A device of claim 24, wherein the control channels are supplied with a pressurized fluid.

Claim 27. (original) A device of claim 25, wherein the control channels are supplied with air.

Claim 28. (original) A device of claim 27, further comprising a transparent substrate layer adjacent to at least one of the treatment and control layers, and wherein at least one of the treatment and control layers is also transparent.

Claim 29. (original) A device of claim 25, further comprising a set of target molecules disposed within the loop channel and at least one detection region coincident with at least a portion of the loop channel.

Claim 30. (original) A device of claim 29, wherein the loop channel is circular.

Claim 31. (original) A microfluidic device comprising:

a treatment layer having elastomeric fluid channels comprising a loop channel, a loop inlet

Appl. No. 09/724,548
Amdt. dated Sep. 13, 2004
Reply to Office action of Apr. 13, 2004

channel, and a loop outlet channel,

a control layer adjacent to the treatment layer and having elastomeric control channels, wherein at least one control channel intersects each of the inlet and outlet channels to form microvalves, and at least three control channels intersect the loop channel to form a peristaltic pump.

Claim 32. (original) A device of claim 31, wherein the elastomeric material is transparent.

Claim 33. (original) A device of claim 31, wherein target molecules are disposed in the loop channel.

Claim 34. (original) A device of claim 33, wherein the target molecules are patterned on a surface of the loop channel.

Claim 35. (original) A device of claim 34, wherein the patterned surface is a transparent substrate that seals at least a portion of the length of the loop channel.

Claim 36. (original) A device of claim 31, wherein the control channels receive a pressurized gas.

Claim 37. (original) A device of claim 36, wherein the loop channel receives fluid from the

Appl. No. 09/724,548
Amdt. dated Sep. 13, 2004
Reply to Office action of Apr. 13, 2004

inlet channel.

Claim 38. (original) A device of claim 37, wherein the fluid is an aqueous liquid and the pressurized gas is air.

Claim 39. (original) A device of claim 38, wherein target molecules are in the loop channel, and further comprising at least one detection region coincident with at least a portion of the loop.

Claim 40. (original) A device of claim 39, wherein the target molecules are patterned on a transparent substrate that seals at least a portion of the length of the loop channel.

Claim 41. (original) A device of claim 40, wherein the pattern of target molecules coincides with a detection region examined by an optical detector.

Claim 42. (original) A device of claim 41, wherein the target molecules are labeled with a reporter.

Claim 43. (original) A device of claim 41, wherein the target molecules are labeled with a fluorescent reporter.

Appl. No. 09/724,548
Amdt. dated Sep. 13, 2004
Reply to Office action of Apr. 13, 2004

Claim 44. (currently amended) A device of claim 41, wherein target molecules are ~~polynucleotides~~polynucleotides.

Claim 45. (original) A device of claim 41, wherein target molecules are polypeptides.

Claim 46. (original) A device of claim 41, wherein target molecules are antibodies.

Claim 47. (original) A device of claim 31, wherein the elastomer is a molded silicon elastomer.

Claim 48. (original) A device of claim 31, wherein channels are formed by soft lithography.

Claim 49. (original) A device of claim 31, further comprising at least one mixing channel in communication with a loop inlet channel.

Claim 50. (original) A device of claim 49, wherein the mixing channel is on the treatment layer and has at least one microvalve provided by an intersecting control channel on the control layer.

Claim 51. (original) A microfluidic device according to claim 1, wherein the loop channel

Appl. No. 09/724,548
Amdt. dated Sep. 13, 2004
Reply to Office action of Apr. 13, 2004

comprises at least one pair of interconnected parallel and antiparallel channels.

Claim 52. (original) A microfluidic device according to claim 51, wherein the loop channel comprises a plurality of pairs of interconnected parallel and anti-parallel channels.

Claim 53. (original) A device according to claim 31 wherein the control lines comprise at least three parallel channels which are carried by the control layer, in which each of the at least three parallel channels intersects at least one channel carried by the treatment layer.

Claim 54. (currently amended) A microfluidic device according to claim 31 wherein the loop channel comprises at least one ~~[[pari]]~~ pair of interconnected parallel and antiparallel channels.

Claim 55. (original) A microfluidic device according to claim 54 wherein the loop channel comprises a plurality of pairs of interconnected parallel and antiparallel channels.

Claim 56. (original) A microfluidic device according to claim 31 wherein the at least three control channels are parallel channels.

Claim 57. (original) A microfluidic device comprising:

Appl. No. 09/724,548
Amdt. dated Sep. 13, 2004
Reply to Office action of Apr. 13, 2004

a plurality of loop channels, each loop channel communicating with at least one service channel;
and a pump associated with each of the plurality of loop channels.

Claim 58. (original) A microfluidic device according to claim 57 wherein the pump associated with a loop channel comprises at least three cooperating microvalves acting within the loop channel.

Claim 59. (original) A microfluidic device according to claim 57 wherein a set of target molecules is disposed within each loop channel.

Claim 60. (original) A microfluidic device comprising:
a treatment layer having elastomeric fluid channels comprising at least one inlet channel, at least one outlet channel, and a plurality of loop channels; and
a control layer adjacent to the treatment layer and having a plurality of parallel elastomeric control channels, wherein at least three control channels intersect each loop channel to form a peristaltic pump.

Claim 61. (original) A microfluidic device according to claim 60 wherein a set of target molecules is disposed within each loop channel.

Claim 62. (original) A microfluidic device according to claim 61 wherein the target molecules

Appl. No. 09/724,548
Amdt. dated Sep. 13, 2004
Reply to Office action of Apr. 13, 2004

are patterned on a substrate that seals at least one portion of the length of each loop channel.

Claim 63. (original) A microfluidic device according to claim 62, wherein

the substrate is a microtiter plate having microtiter wells, each microtiter well having a target molecule patterned thereon; and

the microtiter plate is connected to the treatment layer so that at least a portion of the length of each loop channel is sealed by a microtiter well.

Claim 64. (original) A microfluidic device according to claim 63, wherein the microtiter plate comprises 96 microtiter wells.

Claim 65. (original) A microfluidic device according to claim 63, wherein the microtiter plate comprises 384 microtiter wells.

Claim 66. (original) A microfluidic device according to claim 63 wherein the microtiter plate comprises 1536 microtiter wells.

Claim 67. (currently amended) A microfluidic device according to claim 57 having 96
~~target-loops.~~

Claim 68. (currently amended) A microfluidic device according to claim 57 having 384

Appl. No. 09/724,548
Amdt. dated Sep. 13, 2004
Reply to Office action of Apr. 13, 2004

target loops.

Claim 69. (currently amended) A microfluidic device according to claim 57 having 1536
target loops.